Designation: E2934 – 14

Standard Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) for Eddy Current (EC) Test Methods[1]

This standard is issued under the fixed designation E2934; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice facilitates the interoperability of eddy current imaging and data acquisition equipment by specifying the image data transfer and archival storage in commonly accepted terms. This document is intended to be used in conjunction with Practice E2339 on Digital Imaging and Communication in Nondestructive Evaluation (DICONDE). Practice E2339 defines an industrial adaptation of the NEMA Standards Publication titled Digital Imaging and Communications in Medicine (DICOM, see http://medical.nema.org), an international standard for image data acquisition, review, storage and archival storage. The goal of Practice E2339, commonly referred to as DICONDE, is to provide a standard that facilitates the display and analysis of NDE results on any system conforming to the DICONDE standard. Toward that end, Practice E2339 provides a data dictionary and a set of information modules that are applicable to all NDE modalities. This practice supplements Practice E2339 by providing information object definitions, information modules and a data dictionary that are specific to eddy current test methods.

1.2 This practice has been developed to overcome the issues that arise when analyzing or archiving data from eddy current test equipment using proprietary data transfer and storage methods. As digital technologies evolve, data must remain decipherable through the use of open, industry-wide methods for data transfer and archival storage. This practice defines a method where all the eddy current technique parameters and inspection data are communicated and stored in a standard manner regardless of changes in digital technology.

1.3 This practice does not specify:

1.3.1 A testing or validation procedure to assess an implementation's conformance to the standard,

1.3.2 The implementation details of any features of the standard on a device claiming conformance, or

1.3.3 The overall set of features and functions to be expected from a system implemented by integrating a group of devices each claiming DICONDE conformance.

1.4 Although this practice contains no values that require units, it does describe methods to store and communicate data that do require units to be properly interpreted. The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E1316 Terminology for Nondestructive Examinations

E2339 Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE)

2.2 *NEMA Standards:*[3]

Standard for Digital Imaging and Communications in Medicine (DICOM), 2013

3. Terminology

3.1 *Definitions:*

3.1.1 Nondestructive evaluation terms used in this practice can be found in Terminology E1316.

3.1.2 DICONDE terms used in this practice are defined in Practice E2339.

4. Summary of Practice

4.1 A fundamental principle of DICONDE is the use of standard definitions and attribute formats for data communication and storage. This means all systems that are DICONDE

[1] This test method is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.11 on Digital Imaging and Communication in Nondestructive Evaluation (DICONDE).

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from National Electrical Manufacturers Association (NEMA), 1300 N. 17th St., Suite 1752, Rosslyn, VA 22209, http://www.nema.org.

TABLE 1 EC Image Information Object Information

DICOM Module	DICONDE Module	Reference	Usage[A]
	Component	E2339, Section 7	M
	Component Study	E2339, Section 7	M
	Component Series	Section 7.1	M
Frame of Reference		DICOM Part 3 Section C.7.4.1	U
Synchronization		DICOM Part 3 Section C.7.4.2	U
	NDE Equipment	E2339, Section 7	M
General Image		DICOM Part 3 Section C.7.6.1	M
Image Pixel		DICOM Part 3 Section C.7.6.3	M
Palette Color Lookup Table		DICOM Part 3 Section C.7.9	C – Required if Photometric Interpretation (0028,0004) has a value of PALETTE COLOR
Device		DICOM Part 3 Section C.7.6.12	U
	NDE EC Image	Section 7.2	M
Overlay Plane		DICOM Part 3 Section C.7.9.2	U
VOI LUT		DICOM Part 3 Section C.7.11.2	U
SOP Common		DICOM Part 3 Section C.7.12.1	M
	NDE EC Equipment	Section 7.3	U
	NDE EC Equipment Settings	Section 7.4	U
	NDE Indication	E2339, Section 7	U
	NDE Geometry	E2339, Section 7	U

[A]Definition of usage codes can be found in Part 3 Section A.1.3 of the DICOM standard.

compliant use a common data dictionary and common communication protocols. To further standardization, the elements in the data dictionary are organized into common groups referred to as information modules. The data dictionary and information modules common to all NDE modalities are defined in Practice E2339.

4.2 The data dictionary and information modules specified in Practice E2339 do not cover the information storage requirements for each individual modality (Computed Tomography, Digital Radiography, Computed Radiography, Ultrasonic, etc.). Additions to the data dictionary and information modules are required to support the individual modalities. This practice contains the additions to the DICONDE data dictionary and information modules necessary for eddy current inspection.

4.3 The highest organizational level in the DICONDE information model is the information object definition (IOD). The information object definition is a collection of information modules necessary to represent a set of examination results from a specific modality. This practice contains information object definitions necessary for eddy current inspection.

5. Significance and Use

5.1 Personnel that are responsible for the creation, transfer, and storage of eddy current NDE test results will use this standard. This practice defines a set of information modules that along with the Practice E2339 and the DICOM standard provides a standard means to organize eddy current test parameters and results. The eddy current examination results may be displayed or analyzed on any device that conforms to the standard. Personnel wishing to view any eddy current examination data stored according to Practice E2339 may use this document to help them decode and display the data contained in the DICONDE compliant inspection record.

6. Information Object Definitions

6.1 *Eddy Current Image IOD Description*

6.1.1 The Eddy Current (EC) Image Information Object Definition specifies an image that has been created by an Eddy Current imaging device for NDE purposes. The IOD definition is found in Table 1. Note that eddy current has no equivalent medical imaging modality. While the IOD definition utilizes standard information modules from the DICOM standard there exists no EC IOD within the DICOM standard.

6.1.2 Since there is no EC IOD within the DICOM standard the option of using a DICOM Standard Extended Service-Object Pair (SOP) Class does not exist. A SOP Class Name and Unique Identifier (UID) have been provided to the EC IOD in Table 3. Note that since this is not a DICOM SOP Class, many standard DICOM image display and storage tools may not accept these images.

6.2 *Eddy Current Multi-Frame Image*

6.2.1 The Eddy Current Multi-Frame (EC-MF) Image Information Object Definition specifies a multi-frame image that has been created by an Eddy Current imaging device for NDE purposes. The IOD definition is found in Table 2. Note that eddy current multi-frame has no equivalent medical imaging modality. While the IOD definition utilizes standard information modules from the DICOM standard there exists no EC-MF IOD within the DICOM standard.

6.2.2 Since there is no EC-MF IOD within the DICOM standard the option of using a DICOM Standard Extended Service-Object Pair (SOP) Class does not exist. A SOP Class Name and Unique Identifier (UID) have been provided to the EC-MF IOD in Table 3. Note that since this is not a DICOM

TABLE 3 SOP Class Definitions

SOP Class Name	SOP Class UID	IOD Specification
Eddy Current Image Storage	1.2.840.10008.5.1.4.1.1.601.1	EC IOD (See 6.1)
Eddy Current Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.601.2	EC-MF IOD (See 6.2)

TABLE 2 EC-MF Image Information Object Definition

DICOM Module	DICONDE Module	Reference	Usage[A]
	Component	E2339, Section 7	M
	Component Study	E2339, Section 7	M
	Component Series	Section 7.1	M
Frame of Reference		DICOM Part 3 Section C.7.4.1	U
Synchronization		DICOM Part 3 Section C.7.4.2	U
	NDE Equipment	E2339, Section 7	M
General Image		DICOM Part 3 Section C.7.6.1	M
Image Pixel		DICOM Part 3 Section C.7.6.3	M
Cine		DICOM Part 3 Section C.7.6.5	M
Multi-frame		DICOM Part 3 Section C.7.6.6	M
Frame Pointers		DICOM Part 3 Section C.7.6.9	M
Palette Color Lookup Table		DICOM Part 3 Section C.7.9	C – Required if Photometric Interpretation (0028,0004) has a value of PALETTE COLOR
Device		DICOM Part 3 Section C.7.6.12	U
	NDE EC Image	Section 7.2	M
VOI LUT		DICOM Part 3 Section C.7.11.2	U
SOP Common		DICOM Part 3 Section C.7.12.1	M
	NDE EC Equipment	Section 7.3	U
	NDE EC Equipment Settings	Section 7.4	U
	NDE Indication	E2339, Section 7	U
	NDE Geometry	E2339, Section 7	U

[A]Definition of usage codes can be found in Part 3 Section A.1.3 of the DICOM standard.

SOP Class, many standard DICOM image display and storage tools may not accept these images.

7. Information Modules

7.1 *Component Series Module*

7.1.1 The Component Series Module for eddy current images will be as described in Practice E2339 Section 7, except as noted below.

7.1.1.1 For eddy current images the Modality attribute (0008,0060) will have the value of EC.

7.2 *NDE EC Image Module*

7.2.1 Table 4 specifies the Attributes that describe NDE eddy current images.

7.2.1.1 For NDE EC Images, Samples per Pixel (0028, 0002) is specified to use the following values for specified Photometric Interpretations.

TABLE 5 NDE EC Image Samples Per Pixel

Photometric Interpretation	Samples Per Pixel value
MONOCHROME2	1
RGB	3
PALETTE COLOR	1

7.2.1.2 For NDE EC Images, Photometric Interpretation (0028,0004) is specified to use the following defined terms. See Part 3 Section C.7.6 of the DICOM standard for definitions of the terms:

MONOCHROME2
PALETTE COLOR
RGB

7.2.1.3 For NDE EC Images, Bits Allocated (0028,0100) is specified to use the following values for specified Photometric Interpretations.

TABLE 6 NDE EC Image Bits Allocated

Photometric Interpretation	Bits Allocated Value
MONOCHROME2	8
RGB	8
PALETTE COLOR	8-8 bit palette or 16-16 bit palette

7.2.1.4 For NDE EC Images, Bits Stored (0028,0101) is specified to use the following values for specified Photometric Interpretations.

TABLE 7 NDE EC Image Bits Stored

Photometric Interpretation	Bits Stored Value
MONOCHROME2	8
RGB	8
PALETTE COLOR	8-8 bit palette or 16-16 bit palette

7.2.1.5 For NDE EC Images, Planar Configuration (0028, 0006) is specified to use the following values for specified Photometric Interpretations.

TABLE 8 NDE EC Planar Configuration

Photometric Interpretation	Planar Configuration Value
RGB	0–color by pixel, or 1–color by plane

7.2.1.6 For NDE EC Images, Pixel Representation (0028, 0103) is specified to use the following Enumerated Value:

0000H = unsigned integer
0001H = signed integer

7.2.1.7 For NDE EC multi-frame images, the Attribute Frame Increment Pointer (0028,0009) of the Multi-frame Module (See DICOM Part 3 Section C.7.6.6) is specified by the following defined terms:

00181063 = sequencing by Frame Time (0018,1063)

TABLE 4 NDE EC Image Module Attributes

Attribute Name	Tag	VR	VM	Type	Description
Samples per pixel	(0028,0002)	US	1	1	Number of samples per pixel in this image. See 7.2.1.1.
Photometric Interpretation	(0028,0004)	CS	1	1	Specifies the intended interpretation of the pixel data. See 7.2.1.2.
Bits Allocated	(0028,0100)	US	1	1	Number of bits allocated for each pixel data. See 7.2.1.3.
Bits Stored	(0028,0101)	US	1	1	Number of bits stored for each pixel data. See 7.2.1.4.
High Bit	(0028,0102)	US	1	1	Most significant bit for pixel data.
Planar Configuration	(0028,0006)	US	1	1C	Indicates whether the pixel data is sent color by plane or color by pixel. Required if Samples Per Pixel (0028, 0002) has a value greater than 1. See 7.2.1.5.
Pixel Representation	(0028,0103)	US	1	1	Representation of pixel data. See 7.2.1.6.
Frame Increment Pointer	(0028,0009)	AT	1-n	1C	Contains the Data Element Tag of the attribute that is used as the frame increment in multi-frame pixel data. Required if number of frames is sent. See 7.2.1.7.
Image Type	(0008,0008)	CS	1-n	1	Image identification characteristics. See 7.2.1.8.
Lossy Image Compression	(0028,2110)	CS	1	1C	Specifies whether an image has undergone lossy compression. Enumerated Values: 00 = NO lossy compression 01 = Lossy compression Required if lossy compression has been performed on the image.
Number of Surfaces	(0008,2124)	IS	1	3	Number of distinct scan surfaces on the inspection specimen.
Number of Total Channels	(0008,212A)	IS	1	3	Number of examination channels associated in this scan surface
Surface Name	(0008,2120)	SH	1	3	Name of this scan surface
Surface Number	(0008,2122)	IS	1	3	Number of this scan surface
Channel Name	(0008,2127)	SH	1	3	Name of this examination channel
Channel Number	(0008,2128)	IS	1	3	Number of this examination channel
Pixel Data Type	(0018,6014)	US	1	3	The type of data encoded in the pixel data. See 7.2.1.9. for enumerated values.
Pixel Value Transformation Sequence	(0028,9145)	SQ	1	3	Contains the attributes involved in the transformation of stored pixel values to physical units.
>Rescale Intercept	(0028,1052)	DS	1	1C	The value b in relationship between pixel values (PV) and output units. Output units = m*PV+b Required value if sequence is present.
>Rescale Slope	(0028,1053)	DS	1	1C	Parameter m in the equation specified by Rescale Intercept (0028,1052) Required value if sequence is present.
>Rescale Type	(0028,1054)	LO	1	1C	Specifies the output unit of Rescale Slope (0028, 1053) and Rescale Intercept (0028,1052). See 7.2.1.10 for list of units. Required value if sequence is present.
Acquisition Date/Time	(0008,002A)	DT	1	3	The date and time that the acquisition of data that resulted in this image started.
Physical Units X Direction	(0018,6024)	US	1	1	The physical units of the dimension of the region. See 7.2.1.11 for valid values.
Physical Units Y Direction	(0018,6026)	US	1	1	The physical units of the dimension of the region. See 7.2.1.11 for valid values.
Physical Delta X	(0018,602C)	FD	1	1	The physical value per positive X pixel increment. The units are as specified in the Physical Units X Direction (0018,6024) See 7.2.1.12.
Physical Delta Y	(0018,602E)	FD	1	1	The physical value per positive Y pixel increment. The units are as specified in the Physical Units Y Direction (0018,6024) See 7.2.1.12.

00181065 = sequencing by Frame Time Vector (0018,1065)

7.2.1.8 For NDE EC Images, Image Type (0008,0008) is specified to be Type 2. The defined terms for value 3 are:

C SCAN
B SCAN
A SCAN
STRIP CHART
PHASE PLANE
IMPEDANCE PLANE

Value 4 contains information about the eddy current examination mode. The defined terms for value 4 are:

ABSOLUTE

DIFFERENTIAL
DOUBLE DIFF
TANG CROSS AXIS
REFLECTION

7.2.1.9 Pixel Data Type (0018,6014) provides Enumerated Values indicating the type of data encoded in the pixel data values.

Value	Meaning	Value	Meaning
0000H=	None or not applicable	0001H=	Impedance
0002H=	Inductance	0003H=	Voltage
0004H=	Current	0005H=	Field Intensity
0006H=	Flux Density	0007H=	Phase
0008H=	Frequency	0009H=	Time
000AH=	Electrical Conductivity	000BH=	Magnetic Permeability
000CH=	Thickness		

7.2.1.10 Rescale Type (0028,1054) provides Enumerated Values indicating the units for the output transformation on the pixel data defined by the Rescale Intercept (0028,1052) and Rescale Slope (0028,1053).

Value	Meaning	Value	Meaning
NA=	None or not applicable	OHM=	ohms
HEN=	henries	VOL=	volts
AMP=	amperes	AMM=	ampere/metre
TES=	tesla	DEG=	degrees
HZ=	hertz	SEC=	seconds
SIM=	siemens/metre	HEM=	henries/metre
MM=	millimetre		

7.2.1.11 Physical Units X Direction (0018,6024) and Physical Units Y Direction (0018,6026) provide Enumerated Values indicating the physical units of the dimensions of the image.

Value	Meaning	Value	Meaning
0000H=	None or not applicable	0001H=	percent
0002H=	dB	0003H=	cm
0004H=	seconds	0005H=	hertz ($seconds^{-1}$)
0006H=	dB/sec	0007H=	cm/sec
0008H=	cm^2	0009H=	cm^2/sec
000AH=	cm^3	000BH=	cm^3/sec
000CH=	degrees		

7.2.1.12 The Physical Delta X (0018,602C) is the physical value increment per positive X pixel increment, which is left to right. The Physical Delta Y (0018,602E) is the physical value increment per positive Y pixel increment, which is top to bottom.

7.3 *NDE EC Equipment Module—*

7.3.1 Table 9 specifies the attributes that describe NDE eddy current equipment. The nomenclature for the eddy current equipment used in this document is found in Fig. 1. Note that the use of the preamplifier is optional and that one single probe may be used for the Drive Probe and the Receive Probe.

7.3.1.1 For NDE EC Images, Probe Drive Type (0014,4081) is specified to use the following defined terms:

SQUARE PULSE
SQUARE WAVE
SINUSOIDAL
HALF WAVE
TONE BURST
TRIANGULAR
MULTIPLE FREQUENCY

7.3.1.2 For NDE EC Images, Amplifier Type (*Tag to be assigned*) is specified to use the following defined terms:

LINEAR
LOGARITHMIC

7.3.1.3 For NDE EC Images, Probe Type (0018,6031) is specified to use the following defined terms:

REFLECTION
BRIDGE
LINEAR ARRAY
CURVED LIN ARRAY
SECTOR ARRAY
SECTOR ANN ARRAY
MATRIX ARRAY
DIFFERENTIAL

7.3.1.4 For NDE EC Images, Element Shape (0014,4013) is specified to use the following defined terms:

CIRCLE
ELLIPSE
RECTANGLE
RING

7.4 *NDE EC Equipment Settings Module—*

7.4.1 Table 10 specifies the attributes that describe NDE eddy current equipment settings.

7.4.1.1 For NDE EC Images, Modulation Type (0014, 4026) is specified to use the following defined term:

HANNING

7.4.1.2 For NDE EC Images, Probe Mode (0018, 9178) is specified to use the following defined terms:

ABSOLUTE
DIFFERENTIAL
DOUBLE DIFF
TANG CROSS AXIS
REFLECTION

7.4.1.3 For NDE EC Images, Channel Type (0018, 106A) is specified to use the following defined terms:

FLAW
LIST OFF
X
Y
FEATURE
PROPERTY

8. Keywords

8.1 databases; DICOM; DICONDE; digital data storage; digital data transmission; Eddy Current; ET; file format

TABLE 9 NDE EC Equipment Module Attributes

Attribute Name	Tag	VR	VM	Type[A]	Description
Probe Drive Equipment Sequence	(0014,4080)	SQ	1	2	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Manufacturer	(0008,0070)	LO	1	2	Manufacturer of the equipment used to drive the probe.
>Model Number	(0008,1090)	LO	1	3	Manufacturer's model number for the equipment used to drive the probe.
>Serial Number	(0018,1000)	LO	1	3	Manufacturer's serial number for the equipment used to drive the probe.
>Drive Type	(0014,4081)	CS	1	3	Type of drive used in data collection. See 7.3.1.
>Time of Last Calibration	(0018,1201)	TM	1-n	3	Time of the last calibration for the equipment used to drive the probe.
>Date of Last Calibration	(0018,1200)	DA	1-n	3	Date of the last calibration for the equipment used to drive the probe.
>Probe Drive Notes	(0014,4082)	LT	1	3	User-defined comments on the probe drive.
Receiver Equipment Sequence	(0014,4008)	SQ	1	2	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Manufacturer	(0008,0070)	LO	1	2	Manufacturer of the equipment used to receive the eddy current signal.
>Model Number	(0008,1090)	LO	1	3	Manufacturer's model number for the equipment used to receive the eddy current signal.
>Serial Number	(0018,1000)	LO	1	3	Manufacturer's serial number for the equipment used to receive the eddy current signal.
>Amplifier Type	(0014,400A)	CS	1	3	Type of amplifier used in data collection. See 7.2.1.3.
>Time of Last Calibration	(0018,1201)	TM	1-n	3	Time of the last calibration for the equipment used to receive the eddy current signal.
>Date of Last Calibration	(0018,1200)	DA	1-n	3	Date of the last calibration for the equipment used to receive the eddy current signal.
>Receiver Notes	(0014,400C)	LT	1	3	User-defined notes on the receiver equipment.
Pre-Amplifier Equipment Sequence	(0014,400E)	SQ	1	2	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Manufacturer	(0008,0070)	LO	1	2	Manufacturer of the equipment used to pre-amplify the Eddy Current signal.
>Model Number	(0008,1090)	LO	1	3	Manufacturer's model number for the equipment used to pre-amplify the eddy current signal.
>Serial Number	(0018,1000)	LO	1	3	Manufacturer's serial number for the equipment used to pre-amplify the eddy current signal.
>Time of Last Calibration	(0018,1201)	TM	1-n	3	Time of the last calibration for the equipment used to pre-amplify the eddy current signal.
>Date of Last Calibration	(0018,1200)	DA	1-n	3	Date of the last calibration for the equipment used to pre-amplify the eddy current signal.
>Pre-Amplifier Notes	(0014,400F)	LT	1	3	User-defined notes on the preamp equipment.
Drive Probe Sequence	(0014,4083)	LT	1	3	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Manufacturer	(0008,0070)	LO	1	2	Manufacturer of the probe used to transmit the eddy current signal.
>Model Number	(0008,1090)	LO	1	3	Manufacturer's model number for probe used to transmit the eddy current signal.
>Serial Number	(0018,1000)	LO	1	3	Manufacturer's serial number for probe used to transmit the eddy current signal.

TABLE 9 *Continued*

Attribute Name	Tag	VR	VM	Type[A]	Description
>Probe Type	(0018,6031)	CS	1	3	Type of probe used in data collection. See 7.3.1.1.
>Manufacturer Data	(0018,5010)	LO	1	3	Manufacturer defined code or description for the probe.
>Number of Elements	(0014,4012)	US	1	3	Number of individual coils that make up the probe.
>Element Shape	(0014,4013)	CS	1	3	Primary shape of probe used in data collection. See 7.3.1.1.
>Element Dim A	(0014,4014)	DS	1	3	Dimension of the major axis of the probe coil in cm.
>Element Dim B	(0014,4015)	DS	1	3	Dimension of the minor axis of the probe coil in cm.
>Element Pitch A	(0014,4016)	DS	1	3	Major axis spacing between coils in cm.
>Element Pitch B	(0014,401D)	DS	1	3	Minor axis spacing between coils in cm.
>Nominal Frequency	(0014,401A)	DS	1	3	Nominal center frequency of the probe in Hz.
>Measured Center Frequency	(0014,401B)	DS	1	3	Measured center frequency of the probe in Hz.
>Measured Bandwidth	(0014,401C)	DS	1	3	Measured –3dB bandwidth of the probe in kHz.
>Probe Inductance	(0014,4084)	DS	1	3	Measured probe inductance in micro henries.
>Probe Resistance	(0014,4085)	DS	1	3	Measured probe resistance in ohms.
Receive Probe Sequence	(0014,4086)	LT	1	3	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Manufacturer	(0008,0070)	LO	1	2	Manufacturer of the probe used to receive the eddy current signal.
>Model Number	(0008,1090)	LO	1	3	Manufacturer's model number for probe used to receive the eddy current signal.
>Serial Number	(0018,1000)	LO	1	3	Manufacturer's serial number for probe used to receive the eddy current signal.
>Probe Type	(0018,6031)	CS	1	3	Type of probe used in data collection. See 7.3.1.1.
>Manufacturer Data	(0018,5010)	LO	1	3	Manufacturer defined code or description for the probe.
>Number of Elements	(0014,4012)	US	1	3	Number of individual coils that make up the probe.
>Element Shape	(0014,4013)	CS	1	3	Primary shape of probe used in data collection. See 7.3.1.2.
>Element Dim A	(0014,4014)	DS	1	3	Dimension of the major axis of the probe coil in cm.
>Element Dim B	(0014,4015)	DS	1	3	Dimension of the minor axis of the probe coil in cm.
>Element Pitch A	(0014,4016)	DS	1	3	Major axis spacing between coils in cm.
>Element Pitch B	(0014,401D)	DS	1	3	Minor axis spacing between coils in cm.
>Nominal Frequency	(0014,401A)	DS	1	3	Nominal center frequency of the probe in Hz.
>Measured Center Frequency	(0014,401B)	DS	1	3	Measured center frequency of the probe in Hz.
>Measured Bandwidth	(0014,401C)	DS	1	3	Measured –3dB bandwidth of the probe in kHz.
>Probe Inductance	(0014,4084)	DS	1	3	Measured probe inductance in micro henries.
>Probe Resistance	(0014,4085)	DS	1	3	Measured probe resistance in ohms.

[A]Definition of type codes can be found in Part 5 Section 7.4 of the DICOM standard.

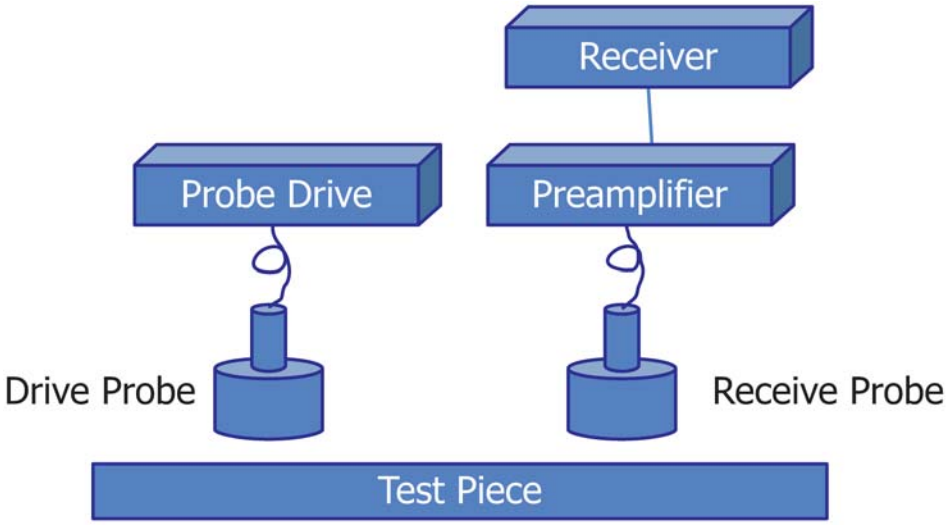

FIG. 1 Eddy Current Equipment Architecture Nomenclature

TABLE 10 NDE EC Equipment Settings Module Attributes

Attribute Name	Tag	VR	VM	Type[A]	Description
Probe Drive Settings Sequence	(0014,4087)	SQ	1	2	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Data Sample Rate	(0018,6032)	UL	1	3	The signal sample frequency used to collect the eddy current data. The units are in hertz.
>Signal Height	(0018,5000)	SH	1-n	3	Character string description of the probe drive coil output levels used in generating a given image. Data may be expressed in volts, amps, dB, %, W/cm^2, etc.
>Pulse Width	(0014,4022)	DS	1	3	Width in msec of the eddy current pulse used to generate a given image.
>Excitation Frequency	(0014,4024)	DS	1	3	Frequency of the excitation waveform in Hz for Tone Burst type.
>Modulation Type	(0014,4026)	CS	1	3	Type of modulation window used for Tone Burst. See 7.3.1.1 for details.
>High Pass Filter	(003A,0221)	DS	1	3	Nominal 3dB point of lower frequency of pass band; in Hz.
>Low Pass Filter	(003A,0220)	DS	1	3	Nominal 3dB point of upper frequency of pass band; in Hz.
>Bridge Resistors	(0014,4088)	DS	1	3	Nominal 3dB point of upper frequency of pass band; in Hz.
Receiver Settings Sequence	(0014,4030)	SQ	1	2	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Center Frequency	(003A,0222)	DS	1	3	Center point of the 3dB pass band; in Hz.
>Bandwidth	(003A,0223)	DS	1	3	Width of the 3dB pass band; in Hz.
>High Pass Filter	(003A,0221)	DS	1	3	Nominal 3dB point of lower frequency of pass band; in Hz.
>Low Pass Filter	(003A,0220)	DS	1	3	Nominal 3dB point of upper frequency of pass band; in Hz.
>Fixed Gain	(003A,0218)	DS	1	3	Amount of fixed signal amplification applied to eddy current image data; in dB.
>User Selected Gain X	(003A,0210)	DS	1	3	Amount of variable signal amplification applied to eddy current image data; in dB.
>User Selected Gain Y	(0014,408B)	DS	1	3	Amount of variable signal amplification applied to eddy current image data; in dB.
>User Selected Offset X	(0014,408D)	DS	1	3	Amount of variable signal offset applied to eddy current image data; in units used for image.
>User Selected Offset Y	(0014,408E)	DS	1	3	Amount of variable signal offset applied to eddy current image data; in units used for image.
>User Selected Phase	(0014,408C)	DS	1	3	Phase angle of measurement system relative to probe drive.
Pre-Amplifier Settings Sequence	(0014,4040)	SQ	1	3	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Center Frequency	(003A,0222)	DS	1	3	Center point of the 3dB pass band; in Hz.
>Bandwidth	(003A,0223)	DS	1	3	Width of the 3dB pass band; in Hz.
>High Pass Filter	(003A,0221)	DS	1	3	Nominal 3dB point of lower frequency of pass band; in Hz.
>Low Pass Filter	(003A,0220)	DS	1	3	Nominal 3dB point of upper frequency of pass band; in Hz.
>Fixed Gain	(003A,0218)	DS	1	3	Amount of fixed signal amplification applied to eddy current image data; in dB.
>User Selected Gain	(003A,0210)	DS	1	3	Amount of variable signal amplification applied to eddy current image data; in dB.
Drive Probe Sequence	(0014,4083)	SQ	1	3	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.

TABLE 10 *Continued*

Attribute Name	Tag	VR	VM	Type[A]	Description
>Mode	(0018,9178)	CS	1	3	Eddy current examination mode used to collect the data. See 7.4.1.2.
>Probe Orientation Angle	(0014,4089)	DS	1	3	Orientation angle of drive for directional probes; in degrees.
>Probe Center Location X	(0014,4058)	DS	1	3	Location of the probe center parallel to the surface of the test specimen in cm.
>Probe Center Location Z	(0014,4059)	DS	1	3	Location of the probe center perpendicular to the surface of the test specimen in cm.
Receive Probe Sequence	(0014,4086)	SQ	1	3	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Mode	(0018,9178)	CS	1	3	Eddy current examination mode used to collect the data. See 7.4.1.2.
>Probe Center Location X	(0014,4058)	DS	1	3	Location of the probe center parallel to the surface of the test specimen in cm.
>Probe Center Location Z	(0014,4059)	DS	1	3	Location of the probe center perpendicular to the surface of the test specimen in cm.
Channel Settings Sequence	(0014,4091)	SQ	1	3	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Channel Type	(0018,106A)	DS	1	3	The type of channel used to collect the eddy current data. See 7.4.1.3.
>Channel Threshold	(0014,4092)	DS	1	3	The minimum value above which data is collected.
Standardization Settings Sequence	(0014.4070)	SQ	1	2	
>Channel Name	(0008,2127)	SH	1	3	Name of this examination channel.
>Channel Number	(0008,2128)	IS	1	3	Number of this examination channel.
>Standardization Procedure	(0014,4072)	ST	1	3	Description of the standardization procedure for the instrument used for collecting the image data.
>Procedure Version	(0014,4074)	SH	1	3	Version of the standardization procedure used in collecting the data.
>Procedure Creation Date	(0014,4076)	DA	1	3	Creation date of the standardization procedure used in collecting the data.
>Procedure Expiration Date	(0014,4078)	DA	1	3	Expiration date of the standardization procedure used in collecting the eddy current data.
>Procedure Last Modified Date	(0014,407A)	DA	1	3	Date of last modification for the Standardization procedure used in collecting the eddy current data.
>Standardization Time	(0014,407C)	TM	1-n	3	The time the eddy current data collection system was calibrated for this image.
>Standardization Date	(0014,407E)	DA	1-n	3	The date the eddy current data collection system was calibrated for this image.
Scanner Settings Sequence	(0014,409A)	SQ	1	3	
>Scan Procedure	(0014,409B)	ST	1	3	Description of the scan procedure pattern (e.g., raster or linear), and overlap of channels for image
>Translation Rate X Direction	(0014,409C)	DS	1	3	Scanner speed for motion in this direction; in mm/sec.
>Translation Rate Y Direction	(0014,409D)	DS	1	3	Scanner speed for motion in this direction; in mm/sec
>Channel Overlap	(0014,409F)	DS	1	3	Length of the common response between channels; in mm/sec.

[A]Definition of type codes can be found in Part 5 Section 7.4 of the DICOM standard.